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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/540,733	KATHIRGAMANATHAN ET AL.	
	Examiner	Art Unit	
	Marie R. Yamnitzky	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 November 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *74-90* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *74-90* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

1. This Office action is in response to applicant's amendment filed November 18, 2008, which cancels claims 48-73 and adds claims 74-90.

Claims 74-90 are pending.

2. All objections and rejections as set forth in the Office action mailed May 15, 2008 are rendered moot by claim cancellation.

3. Claims 74-90 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Support for the negative limitation of a layer of an electron transport material "not containing a rare earth element" is not clear. While the application as originally filed did not specifically disclose materials containing a rare earth element for the electron transport material, the absence of a positive recitation is not basis for exclusion.

4. Claims 74-90 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 74 and dependents: It is not clear if layers (a)-(e), particularly layers (b)-(d), must be present in the structure in the order listed in claim 74.

The layer structure as further defined by claim 75, with claims 76 and 77 dependent therefrom, is not clear because the location of layer (d) in relation to layers (f) and (g) is not clear.

Claim 77 recites "α-NBP". This abbreviation is not used elsewhere in the application. (It appears that this may be a typographical error and that "α-NBP" should read --α-NPB--.)

Claims 81 and 90 require the second complex to emit light "predominantly in the ultraviolet region of the spectrum." The limitations imposed by this claim language are not clear because the metes and bounds of "predominantly" are not clear. It is not certain if this means that the peak emission wavelength of the emission spectrum of the complex must be within the ultraviolet region, or if more than 50% of the emission spectrum must be within the ultraviolet region, or some other limitation.

Claim 88 and dependents: The structure of layer (b) is not clear in requiring a first complex "alternating" with at least one layer comprising a second complex. It is not clear if the "alternating" language requires the first complex to be in at least two different layers, with at least one layer of the second complex being positioned between two layers of the first complex, or if it is sufficient for the first complex to be in one layer.

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 74-76, 78, 79, 84, 85, 88 and 89 are rejected under 35 U.S.C. 103(a) as being unpatentable over Egusa et al. (US 5,343,050) in view of Verhoeven et al (US 2003/0012979 A1).

Egusa et al. disclose an electroluminescent (EL) device comprising, in the order listed, an anode, a hole transporting layer, multiple layers of light emitting material, an electron transporting layer, and a cathode. The multiple layers of light emitting material consist of alternating layers of two materials wherein one of the materials has a larger band gap than the other. For example, see Fig. 27, Fig. 57, Fig. 58, column 28, line 17-c. 29, l. 16 and Example 38 (c. 68, l. 15-c. 69, l. 21; with the chemical formulae for (C82) and (C84) shown in c. 66).

Egusa's device of Example 38 has an anode made of ITO, a cathode made of aluminum, a layer of hole transport material, a layer of electron transport material, and a light emitting layer consisting of multiple films of a light emitting material having a band gap of 2.1 eV and multiple films of a light emitting material having a band gap of 2.5 eV, with a film of the 2.5 eV band gap material being disposed between each successive pair of films of the 2.1 eV material. This device structure meets the limitations of the device of claims 74-76, 85 and 88 except for the composition of the layers of light emitting material. Egusa et al. do not disclose the use of electroluminescent metal complexes and/or organometallic complexes as the light emitting materials.

A variety of different metal complexes were known in the art at the time of the invention as being suitable for use as light emitting materials in the light emitting layer of an

electroluminescent device, and the various known metal complexes do not all have the same band gap.

For example, Verhoeven et al. disclose luminescent lanthanide metal complexes that may be used in EL devices. Verhoeven et al. teach that the complexes in which the metal is Ce(III), Eu(II) or Tm(III) emit blue light, Tb(III) complexes emit green light, Eu(III), Dy(III) and Sm(III) complexes emit orange/red light, and Nd(III), Yb(III) and Er(III) complexes emit near infra-red light. For example, see paragraphs [0001] and [0015]-[0019]. Band gap is related to emission color and wavelengths of light emitted, with band gap increasing in the direction from red light to blue light in the spectrum of light. A material that emits red light has a narrower band gap than a material that emits green light; a material that emits green light has a narrower band gap than a material that emits blue light. Even materials emitting the same color may have a slightly different bandgap since each color of light covers a range of wavelengths.

It would have been within the level of ordinary skill of a worker in the art at the time of the present invention to utilize other known light-emitting materials to make a device having a light emitting layer made of alternating layers of materials of different band gaps as taught by Egusa et al. One of ordinary skill in the art at the time of the invention would have been motivated to provide a device having a light emitting layer made of alternating layers of materials of different band gaps for the advantages of such as a device construction as taught by Egusa et al., and it would have been within the level of ordinary skill of a worker in the art at the time of the invention to select combinations of two light-emitting materials within Egusa's guidelines.

Verhoeven's complexes are electroluminescent metal complexes, with some complexes having larger band gaps than other complexes. Accordingly, combinations of complexes can be selected from Verhoeven's complexes to provide the alternating layers of different band gaps as required by the present claims and as required for embodiments within the scope of Egusa's disclosure. Verhoeven's complexes include complexes meeting the further limitations recited in present claims 78 and 79.

With respect to the thickness limitation of present claims 84 and 89, each of the multiple films within the light emitting layer of Egusa's device of Example 38 has a thickness of 3 nm, but Egusa's embodiment having the multiple films of alternating band gaps is not limited to thicknesses set forth with respect to Example 38. Absent a showing of criticality for a thickness of 10 nm for one layer of the multiple layers as in present claims 84 and 89, it is the examiner's position that it would have been within the level of ordinary skill of a worker in the art at the time of the invention to determine suitable thicknesses for the various layers sufficient to provide a functional device.

7. Claims 77, 86 and 87 are rejected under 35 U.S.C. 103(a) as being unpatentable over Egusa et al. (US 5,343,050) in view of Verhoeven et al (US 2003/0012979 A1) as applied to claims 74-76, 78, 79, 84, 85, 88 and 89 above, and further in view of Mori et al. (US 5,281,489).

With respect to claim 77, the hole injection (transporting) layer of Egusa's Example 38 is made of an aromatic amine that is very similar to TPD, but lacks the two methyl groups of TPD. TPD was known in the art at the time of the invention to be useful as a hole transporting

material as evidenced by Mori et al. (e.g. see col. 4, l. 44-46). Further, all of the compounds listed in claim 77 were known in the art at the time of the present invention, and are tertiary aromatic amine compounds as generically taught by Mori et al. as useful hole transporting materials (e.g. see c. 4, l. 46).

With respect to claims 86 and 87, Egusa's Example 38 uses a benzoxazole compound in the electron injection (transporting) layer, rather than a metal quinolinate complex. Metal quinolinate complexes were known in the art at the time of the invention to be useful as electron transporting materials as evidenced by Mori et al. (e.g. see col. 8, l. 29-30; and see Example 63 in which an aluminum quinolinate is used).

It would have been within the level of ordinary skill of a worker in the art at the time of the invention to determine other suitable hole transporting materials and other suitable electron transporting materials, selected from materials known in the art at the time of the invention, that could be used to make devices similar to Egusa's device of Example 38.

8. Claims 74-82 and 84-90 are rejected under 35 U.S.C. 103(a) as being unpatentable over Egusa et al. (US 5,343,050) in view of Kathirgamanathan (WO 98/58037).

Egusa et al. disclose an electroluminescent (EL) device comprising, in the order listed, an anode, a hole transporting layer, multiple layers of light emitting material, an electron transporting layer, and a cathode. The multiple layers of light emitting material consist of alternating layers of two materials wherein one of the materials has a larger band gap than the

other. For example, see Fig. 27, Fig. 57, Fig. 58, column 28, line 17-c. 29, l. 16 and Example 38 (c. 68, l. 15-c. 69, l. 21; with the chemical formulae for (C82) and (C84) shown in c. 66).

Egusa's device of Example 38 has an anode made of ITO, a cathode made of aluminum, a layer of hole transport material, a layer of electron transport material, and a light emitting layer consisting of multiple films of a light emitting material having a band gap of 2.1 eV and multiple films of a light emitting material having a band gap of 2.5 eV, with a film of the 2.5 eV band gap material being disposed between each successive pair of films of the 2.1 eV material. This device structure meets the limitations of the device of claims 74-76, 85 and 88 except for the composition of the layers of light emitting material. Egusa et al. do not disclose the use of electroluminescent metal complexes and/or organometallic complexes as the light emitting materials.

A variety of different metal complexes were known in the art at the time of the invention as being suitable for use as light emitting materials in the light emitting layer of an electroluminescent device, and the various known metal complexes do not all have the same band gap.

For example, Kathirgamanathan disclose luminescent metal complexes that may be used in EL devices. In addition to the complexes set forth in Kathirgamanathan's examples, which do not all emit the same color, this reference also demonstrates by way of discussion of various prior art disclosures that various luminescent metal complexes capable of emitting different colors were known in the art at the time of the invention. Band gap is related to emission color and wavelengths of light emitted, with band gap increasing in the direction from red light to blue

light in the spectrum of light. A material that emits red light has a narrower band gap than a material that emits green light; a material that emits green light has a narrower band gap than a material that emits blue light. Even materials emitting the same color may have a slightly different bandgap since each color of light covers a range of wavelengths.

It would have been within the level of ordinary skill of a worker in the art at the time of the present invention to utilize other known light-emitting materials to make a device having a light emitting layer made of alternating layers of materials of different band gaps as taught by Egusa et al. One of ordinary skill in the art at the time of the invention would have been motivated to provide a device having a light emitting layer made of alternating layers of materials of different band gaps for the advantages of such as a device construction as taught by Egusa et al., and it would have been within the level of ordinary skill of a worker in the art at the time of the invention to select combinations of two light-emitting materials within Egusa's guidelines.

Kathirgamanathan's disclosure demonstrates that various electroluminescent metal complexes, with some complexes having larger band gaps than other complexes, were known in the art at the time of the invention. Accordingly, combinations of complexes can be selected from known complexes to provide the alternating layers of different band gaps as required by the present claims and as required for embodiments within the scope of Egusa's disclosure. Complexes of Kathirgamanathan's examples and/or complexes of the prior art discussed in this reference meet the further limitations recited in present claims 78-82 and 90. For example, with respect to the metals required for claims 79 and 82, see the fifth paragraph on page 3. With

respect to claims 81 and 90, the fifth paragraph on page 2 mentions that metal complexes that emit in the ultraviolet region are known. The Eu complex of Kathirgamanathan's Example 6 is $Eu(DBM)_3OPNP$, which meets the limitations of the first complex as further defined by present claims 78-80. $Eu(TMHD)_3OPNP$, which is also recited in present claim 80 and meets the limitations of the first complex as further defined by present claims 78-80, is not expressly provided as an example in Kathirgamanathan's disclosure, but would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention given the complex of prior art Example 1, which is $Tb(TMHD)_3OPNP$, and the similar Eu complex of prior art Example 10.

With respect to claim 77, the hole injection (transporting) layer of Egusa's Example 38 is made of an aromatic amine that is very similar to TPD, but lacks the two methyl groups of TPD. TPD was known in the art at the time of the invention to be useful as a hole transporting material, and is taught for that use by Kathirgamanathan in the first paragraph on page 5 (also see p. 16 and the claims of this reference). Further, all of the compounds listed in claim 77 were known in the art at the time of the present invention to be useful hole transporting materials.

With respect to claims 86 and 87, Egusa's Example 38 uses a benzoxazole compound in the electron injection (transporting) layer, rather than a metal quinolinate complex. Metal quinolinate complexes were known in the art at the time of the invention to be useful as electron transporting materials, and are taught for that use by Kathirgamanathan in the third paragraph on page 5 (also see p. 16 and the claims of this reference).

It would have been within the level of ordinary skill of a worker in the art at the time of the invention to determine other suitable hole transporting materials and other suitable electron

transporting materials, selected from materials known in the art at the time of the invention, that could be used to make devices similar to Egusa's device of Example 38.

With respect to the thickness limitation of present claims 84 and 89, each of the multiple films within the light emitting layer of Egusa's device of Example 38 has a thickness of 3 nm, but Egusa's embodiment having the multiple films of alternating band gaps is not limited to thicknesses set forth with respect to Example 38. Absent a showing of criticality for a thickness of 10 nm for one layer of the multiple layers as in present claims 84 and 89, it is the examiner's position that it would have been within the level of ordinary skill of a worker in the art at the time of the invention to determine suitable thicknesses for the various layers sufficient to provide a functional device.

9. Claims 74-78 and 85-88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US 2002/0125818 A1) in view of Forrest et al. (US 6,310,360 B1).

Sato et al. disclose an organic electroluminescent (EL) device in which a light emitting layer is disposed between an anode and a cathode. The device may further comprise a hole transporting layer between the anode and the light-emitting layer, and an electron transporting layer between the cathode and the light-emitting layer. The light-emitting layer comprises a host material, Compound A and Compound B. Various organometallic complexes are disclosed for use as Compound A, and organometallic compounds may also be used for Compound B. In paragraph [0159], Sato et al. teach the use of iridium complexes for both Compound A and Compound B, or the use of an iridium complex for one and a platinum complex for the other. As

taught in paragraph [0160], the maximum light emission wavelength of Compound B is longer than the maximum light emission wavelength of Compound A, which correlates to a larger bandgap for Compound A than for Compound B. Compound A functions as a sensitizer, transferring energy to Compound B and intensifying emission from Compound B. In paragraph [0183], Sato et al. teach that Compound A and Compound B may be uniformly distributed in the layer or may be non-uniformly present.

Sato et al. do not disclose the use of alternating layers wherein layers comprising Compound A are alternated with layers comprising Compound B.

Forrest et al. disclose an organic EL device in which a light emitting layer is made of two compositions, one comprising a host and a first light emitting material, and the second comprising a host and a second light emitting material. The two compositions are deposited as alternating layers to form a light emitting layer having a stack of layers. The stack of layers are said to be an approximation of a mixed layer comprising the host and the two light emitting materials. One of the light emitting materials functions as a sensitizer for the other light emitting material.

Given the disclosure of Forrest et al., it would have been an obvious modification to one of ordinary skill in the art at the time of the invention to provide a device wherein the light emitting region has a host, Compound A and Compound B, and to form the light emitting region as a stack of layers in which layers made of the host and Compound A alternate with layers made of the host and Compound B. Given Forrest's disclosure, one of ordinary skill in the art at the time of the invention would have expected that a light emitting region having an arrangement

of alternating layers of host with Compound A and host with Compound B would have functioned in the same manner as a light emitting region made of a single layer in which host, Compound A and Compound B are mixed together.

With respect to the anode material of claim 76, the hole transport material of claim 77, the cathode material of claim 85, and the electron transport material of claims 86 and 87, Sato et al. and/or Forrest et al. disclose materials within the scope of each of these claims. For example, see paragraphs [0169] and [0173] of the Sato publication for disclosure of anode and hole transporting materials, respectively. (Due to a printing error, portions of Sato's disclosure pertaining to specific materials for the cathode and electron transport layer did not get published in the '818 publication.) See column 10, lines 54-65, Example 1 (c. 13, l. 15-50), c. 18, l. 35-51 and Fig. 1 of the Forrest patent.

10. Regarding claim interpretation:

Claims 77, 80 and 83 set forth various abbreviations.

The examiner interprets the abbreviation "TPD" as referring to the diamine compound named prior to recitation of "(TPD)" in claim 77. (The examiner notes that the formula set forth in Fig. 16b does not correspond to the chemical name set forth in claim 77 and elsewhere in the application for "TPD" because the formula in the figure shows one of the methyl groups at the wrong position, based on the name.)

The examiner interprets the abbreviations "HTM-1", "TPTE", and "mTADATA" as referring to the amine compounds represented by the formulae set forth in Fig. 15a, 15b and 16c,

respectively (with the expectation that in Fig. 16c, the "floating" CH_3 should be shown attached to the line extend from the lower ring phenyl ring).

The examiner interprets "α-NBP" as referring to α-NPB as represented by the formula shown in Fig. 16a.

The examiner interprets "TMHD" as referring to 2,2,6,6-tetramethyl-3,5-heptanedionato (per the specification p. 16, l. 9-11), interprets "DBM" as referring to dibenzoyl methane (per the specification p. 21, l. 8-9), and interprets "OPNP" as referring to diphenylphosphonimide triphenyl phosphorane (per the specification p. 16, l. 10-11; also formula XVIII on p. 14 wherein Ph is phenyl per p. 14, l. 9).

The examiner interprets "Phen" (claim 83) as referring to phenanthrene (per the specification p. 5, l. 19). Page 5, line 19 provides the only definition of "Phen" in the application as filed. However, the examiner notes that phenanthrene is a hydrocarbon containing three fused benzene rings, and is not within the scope of any of the formulae set forth in the specification as examples of Lα or Lp.

If the examiner's interpretation of any of these abbreviations is incorrect, clarification of the record is required.

11. Miscellaneous:

The specification does not contain a brief description of the drawings, though the examiner notes that each of the figures appears to be referenced at least once in the specification. A brief description of the drawings should be provided.

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

13. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (571) 272-1531. The examiner works a flexible schedule but can generally be reached at this number from 7:00 a.m. to 3:30 p.m. Monday-Friday.

The current fax number for all official faxes is (571) 273-8300. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (571) 273-1531.)

/Marie R. Yamnitzky/
Primary Examiner, Art Unit 1794

MRY
February 14, 2009